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DUCTILE ULTRA-HIGH STRENGTH HOT ROLLED BAINITIC STEELS POSSESSING GOOD TOUGHNESS

Radhakanta Rana [1]*, Carlos Garcia-Mateo [2], Erick Cordova-Tapia [2]

[1]Tata Steel, Wenckebachstraat 1, 1970 CA IJmuiden, The Netherlands

[2] *National Centre for Metallurgical Research (CENIM-CSIC), Avenida Gregorio del Amo 8, Madrid 28040, Spain*

**Corresponding address: e-mail: radhakanta.rana@tatasteeleurope.com*

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The transport industry needs high strength materials for making the lightweight structures in passenger vehicles as well as in heavy-duty vehicles [1, 2]. Carbide-free bainitic (CFB) steels or transformation induced plasticity (TRIP)-aided bainitic-ferritic (TBF) steels are reported to achieve ultrahigh strength to in excess of 1400 MPa with elongation that is high relative to the strength level and in comparison to other steel microstructures [3-5]. This high ductility of CFB or TBF steels originates primarily from their high retained austenite content which causes the TRIP effect. These ultrahigh strength steels in hot rolled (HR) condition have potential for applications in frames and chassis of the vehicles. For these applications, apart from good ductility also a high toughness is required. However, simultaneous achievement of high elongation and toughness in these ultrahigh strength steels is difficult [6].

In this lecture, research on several ultra-high strength carbide-free bainitic steels will be presented. The objective is to optimise the toughness and elongation. The alloying concepts in designing the steels that ensure good weldability and industrial processability, and predictions of their optimal process parameters during hot rolling with the aim of selection of microstructure component will be discussed. It will be shown that a high retained austenite fraction with high stability is necessary to achieve high impact toughness, simultaneously with high elongation. The transition of impact toughness with temperature with correlation to fracture surfaces will also be elucidated for different alloys and processing conditions.

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